



## REMOVABLE ROOF FOR A MOTOR VEHICLE AND METHOD OF MAKING SAME

### BACKGROUND AND SUMMARY OF THE INVENTION

[0001] This application claims the priority of 102 54 132.9 filed in Germany on November 20, 2002, the disclosure of which is expressly incorporated by reference herein.

[0002] The invention relates to a removable roof for a motor vehicle, particularly a passenger car of the sports car type, between a windshield frame and a rollover bar system.

[0003] A roof is known from U.S. Patent 4,133,576 which is inserted into an opening of a vehicle body structure and has two roof halves fitted together in a longitudinal center plane. In one embodiment, a sealing body, which sealingly cooperates with frame profiles of the two roof halves, extends along the longitudinal center plane.

[0004] From German Patent Document DE 29 29 915 A1, a roof arrangement for a motor vehicle is known, which has two roof parts which can be detached from a vehicle body, are mutually connected in a longitudinal center plane of the motor vehicle and are supported by fixed frame parts of the vehicle body. Sealing bodies are provided between the frame parts and the roof parts, are held on the above-mentioned frame parts and, together with sealing sections of the roof parts, implement a sealing function. Each roof part is made of a glass-fiber-reinforced plastic material and has an exterior wall and a first interior wall and

a second interior wall, which interior walls have a clearly thicker wall thickness than the exterior wall.

[0005] It is an object of the invention to provide a removable roof for a passenger car which, while its weight is low, has a high stability. In this case, the roof should constructively be designed such that at least sufficient headroom for the occupants of a passenger car of a defined height is provided.

[0006] According to the invention, this is achieved by providing a removable roof for a motor vehicle, particularly a passenger car of the sports car type, between a windshield frame and a rollover bar system, which roof is made of a plastic material and comprises an exterior wall as well as an interior wall, wherein the exterior wall and the interior wall of the roof are made of a high-strength plastic material and form a rigid member connection, the exterior wall and the interior wall essentially meeting only at edge zones of the roof.

[0007] Important advantages achieved by means of preferred embodiments of the invention are that the exterior wall and the interior wall, which consist of a high-strength plastic material and are relatively thin-walled, form a rigid support connection, whereby the roof elements of the roof easily withstand not only the strains, for example, between a windshield frame and a rollover bar, but also have a weight which promotes an easy handling - mounting and demounting. The exterior wall and the interior wall extend at a relatively narrow distance from one another which, at the given vehicle height, ensures an acceptably good headroom for the occupants of the passenger car. Finally, the profilings of the interior wall, on the one hand, optimize the stability of the roof

elements and, on the other hand, are suitable for receiving add-on pieces, such as locks, sealing bodies, or the like.

[0008] The drawing illustrates an embodiment of the invention which will be explained in detail in the following.

[0009] Other objects, advantages and novel features of the present invention will become apparent from the following detailed description of the invention when considered in conjunction with the accompanying drawings.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

[0010] Figure 1 is a top view of a passenger car, constructed according to preferred embodiments of the invention;

[0011] Figure 2 is a sectional view taken along Line II-II of Figure 1; and

[0012] Figure 3 is a sectional view taken along Line III-III.

#### **DETAILED DESCRIPTION OF THE DRAWINGS**

[0013] A passenger car 1 of the sports car type - dynamic- appearing styling and superior driving performance - comprises a vehicle body 2 with two opposite side doors 3 provided with door window glass panes 4. The vehicle body 2 bounds an occupant compartment 5 and has a windshield frame 6 and a rollover bar system 7. The occupant compartment 5 is overarched by a removable roof 8 which is supported on the windshield frame 6 and on the rollover system 7. The roof 8, which easily can be detached from the passenger car 1 and be fixed again on it, is formed by two roof elements 9 and 10 which are fitted together in a

longitudinal center plane A-A and, when separated from the vehicle body, can be stored, for example, in a storage space integrated in the vehicle body 2. Each roof element 9 has an exterior wall 11 as well as an interior wall 12 - Figure 2 - which are relatively thin-walled, are produced separately from one another and consist of a high-strength - for example, carbon-fiber-reinforced - plastic material - CFK -. For forming a rigid member connection 13, the exterior wall 11 and the interior wall 12 meet at the edge zones RI, RII, RIII, RIV and RV of the roof element and are connected with one another, for example, by gluing. In order to achieve a stability of the member connection 13 which is as high as possible and also an easily paintable outer surface of the exterior wall 11 - no pressure points -, the exterior wall 11 and the interior wall 12 extend at a relatively narrow mutual distance  $A_s$  over a significant area  $B_w$ . As a result of this embodiment, at the given vehicle height, the headroom for the occupants can be designed in an advantageous manner.

[0014] In a longitudinal sectional view of the passenger car 1 according to Figure 2, at least the interior wall 12 adjacent to the forward edge zone RI and to the rearward edge zone RII is provided with a first profiling P1 and a second profiling P2 respectively, and, in the proximity of the second profiling P2, a third profiling P3 is worked into the interior wall 12 which faces the windshield frame 6. The second profiling P2 and the third profiling P3, which have an approximately U-shaped cross-section Q2 and Q3, are arranged with respect to one another such that a shaping-in 14 with a U-shaped cross-section is obtained which is used for receiving a manual lever 15 of a roof locking device 16. The latter interacts between the roof 8 or the roof elements 9, 10 and the rollover bar

system 7. Furthermore, the second profiling P2 is constructed for holding the roof locking device 16.

[0015] Figure 3 is a cross-sectional view of the passenger car 1 in the area of the roof 8, which shows that, at the edge zone RIII facing the lateral door window glass pane 4 of the door, the roof element 9 comprises a fourth profiling P4. The fourth profiling P4 has a U-shaped cross-section Q4 which is open toward the door window glass pane 4, is suitable for receiving a first sealing body 17 and reaches around an end area 18 of the above-mentioned door window glass pane 4. Likewise, it is illustrated in this Figure 3 that the roof elements 9, 10 have a fifth profiling P5 and a sixth profiling P6 in the edge zones RIV and RV facing the longitudinal center plane A-A. The sixth profiling P6 has a U-shaped cross-section Q5 which is rotated by 90° and is open toward the fifth profiling P5, the cross-section Q5 having an interior leg 19 and an exterior leg 20. The interior leg 19 carries a second sealing body 21 which is provided with a first sealing lip 22, a hose body 23 and a second sealing lip 24, which sealing lips 22 and 24 bound the hose body 23 on the longitudinal sides 25 and 26. The first sealing lip 22 and the hose body 23 sealingly interact with an interior side 27 of the exterior leg 20 which is constructed in the manner of a flange. In contrast, the fifth profiling P5 is an angular cross-section Q6 which, by means of a flange 28, at least in sections, projects beyond the sixth profiling P6 and the cross-section Q5 respectively and sealingly cooperates with the hose body 23. In this case, the second sealing lip 24 rests on an upright web 29 of the cross-section Q5.

[0016] Finally, a relatively thin-walled but sound-insulating covering wall 31 - Figure 3 - is mounted on an interior side 30 of the interior wall 12, which

covering wall 31 is made of a suitable material, for example, a plastic material, and extends at a distance which is as small as possible from the above-mentioned interior wall 12, so that the headroom for the occupants is not impaired along a significant area of the roof 8. For this purpose, end areas 32 and 33 of the covering wall 31 of the roof element 9 extend flush with the wall sections 34 and 35 of the profilings P4 and P5, in which case the end areas 32 and 33 are connected by means of gluing with corresponding receiving sections 36 and 37 of the interior wall 12.

[0017] The foregoing disclosure has been set forth merely to illustrate the invention and is not intended to be limiting. Since modifications of the disclosed embodiments incorporating the spirit and substance of the invention may occur to persons skilled in the art, the invention should be construed to include everything within the scope of the appended claims and equivalents thereof.